One is not surprised at such confusion of meanings in the productions of men who appear from time to time with crude and hazy schemes for correcting or overthrowing all existing systems of science or philosophy, and who make professors weary by their importunities, but one does not look for it in an honored seat of learning. To find it there makes one wonder whether Helmholtz is unknown, or Maxwell has lived in vain.

Although mechanics as the oldest of sciences has been chosen for these illustrations it is likely that every other branch of science can show similar perversions. We have even known the 'parallels of longitude' to be referred to in all seriousness, but as that was not uttered by a scientific man it is rather to be smiled at than criticized.

D. W. Hering.

CORRECTION.

In No. 277 of Science, I stated that the $MgCl_2$ solution used in my experiments on artificial parthenogenesis was a $20/8n$ solution. I have since found that the assistant who made the Mg-solution used and who has left the laboratory must have made a mistake as the solution contained only about 120 g. of $MgCl_2$ in a liter. This does not affect my results, but might be an obstacle to the successful repetition of my experiments by others.

Jacques Loeb.

Chicago, June 8, 1900.

NOTES ON ELECTRICAL ENGINEERING.

SUBMARINE TELEPHONY.

If waves were sent along a string stretched under water the effect of the water would be to *damp* the motion of the string causing the waves to become more and more attenuated as they travel along the string, and to *distort* the waves so that a wave initially complicated in shape would be smoothed and spread out more and more as it travels along the string.

Assuming the damping or frictional force of the water on the string at a point to be strictly proportional to the sidewise velocity of the string at that point, it can be shown that there is a certain relation between the tension of the string and its weight per unit length for which the attenuation of a wave is a minimum and for which a wave is not distorted as it travels along the string.

A submarine cable for telegraphy behaves in a manner entirely analogous to a string stretched through a viscous fluid as described above. Electrical impulses acting at one end of the cable produce electrical waves which travel along the conductor of the cable. The electrical resistance of the conductor is analogous to the frictional resistance of the water on the string, the self-inductance of the conductor is analogous to the weight of the string and the inductive capacity of the gutta-percha insulation is analogous to the tension on the string.

There is a certain relation between resistance of conductor, self-inductance of conductor, and inductive capacity of the gutta-percha covering for which electrical waves suffer minimum attenuation and no distortion as they travel along the cable. Oliver Heaviside first called attention to this condition for the *distortionless circuit*, as it is called and Dr. M. I. Pupin, in a paper read before the American Physical Society in December, showed that the distortionless condition can be realized practically by *distributed inductance* that is by connecting small coils of wire at intervals along a cable or land line.

The practical importance of the distortionless circuit is great inasmuch as such a circuit would greatly extend the possible speed of ocean telegraphy and perhaps even make ocean telephony possible.

The limit of speed of ocean telegraphy is set mainly by the distortion of the electrical impulses which pass along the cable. This distortion causes the impulses at the receiving end to overlap each other greatly.

The limitation of long distance telephony is set in part by the attenuation of the electrical waves and in part by the distortion of the waves. The first makes it difficult to produce an audible effect at the distant receiver and the second so changes the character of the waves that the sound in the distant receiver becomes more or less indistinct or inarticulate, consonant sounds are especially liable to become confused in this way.

W. S. F.